

AGENDA
CALIFORNIA TRAFFIC CONTROL DEVICES COMMITTEE (CTCDC)

March 13, 2003 MEETING
320 W. 4th Street (Carmel Rm. A), Los Angeles, 90012
TIME 9:00 AM

ORGANIZATION ITEMS

	Estimated Time
1. Introduction	9:00
2. Approval of Minutes (December 5, 2002 Meeting)	9:05
3. Public Comments	9:10
At this time, members of the public may comment on any item not appearing on the agenda. Matters presented under this item cannot be discussed or acted upon by the Committee at this time. For items appearing on the agenda, the public is invited to make comments at the time the item is considered by the Committee. Any person addressing the Committee will be limited to a maximum of five (5) minutes so that all interested parties, have an opportunity to speak. At all times, please state your name, address, and business or organization for the record.	

AGENDA ITEMS

4. Public Hearing (None)	9:30
Prior to adopting rules and regulations prescribing uniform standards and specifications for all official traffic control devices placed pursuant to Section 21400 of the California Vehicle Code (CVC), the Department of Transportation is required to consult with local agencies and hold public hearings.	
5. Request for Experimentation	
03-1 Speed Feedback (Radar Speed) Sign (Experiment request by the City of Whittier)	(Introduction) 9:45 (Fisher)
99-18 Ground Mounted LED Lights On Stop Bars (Experiment Agency-City of Anaheim)	(Final Report) 10:15 (Meis)
00-9 Pedestrian Countdown Signal Head (Experiment Agency-City of Stockton) City has submitted the final report.	(Continued) 10:45 (Tanda) (Borstel)
02-10 Pedestrian Countdown Signal Heads (PCSHs) (To review ongoing experimentation with PCSHs)	(Continued) 11:15 (Larsen)

LUNCH BREAK (12-1)

6. Discussion Items

- | | | |
|------|---|--------------------------------|
| 03-2 | Establishment of Speed Limit on Unpaved Roads
(County of San Bernardino) | (Introduction) 1:00
Babico) |
| 03-3 | National Weather Services Signing (Tsunami) | (Introduction) 1:30
(Meis) |

7. Informational Items

- | | | |
|-------|---|---------------------------------------|
| 99-11 | MUTCD Adoption By Caltrans
(Update by Caltrans) | (Continued) 2:00
(Meis) |
| 00-1 | Bicycle Pavement Markings
(Update by the Consultant) | (Continued) 2:30
(Tanda) (Borstel) |
| 01-12 | BlinkerStop Sign
(Update by the Vendor) | (Meis) 3:00 |

8. Tabled Items

- | | | |
|-------|---|---------------------------------|
| 01-11 | Portable or Temporary Speed Display Sign
(If the speed feedback sign is a traffic control device or not) | (Continued) 3:15
(Meis) |
| 02-16 | Traffic Signal Warrants 1 & 2
(Footnotes were not included in the 1996 Publication) | (Introduction) 3:20
(Babico) |

10. Next Meeting**11. Adjourn**

ITEM UNDER EXPERIMENTATION

- 99-10 TACTILE PEDESTRIAN INDICATORS (Folkers)
(Experiment Agency-The City of Los Angeles) Fisher)
Status: No update received.
- 99-12 SPEED STRIPING FOR SMART CROSSWALKS (Meis)
(Experiment Agency-Caltrans D7)
Status: Contract has been awarded and Construction will begin shortly.
- 99-13 ILLUMINATED PAVEMENT MARKERS ON (Meis)
MEDIAN BARRIERS (Experiment Agency-Caltrans D7)
Status: The project has not been funded yet.
- 00-1 BICYCLE PAVEMENT MARKING (Banks)
(Experiment Agency-City of San Francisco)
Status: The city has received approval to hire a consultant to do the study.
- 00-6 PEDESTRIAN COUNTDOWN SIGNAL HEADS (Banks)
(Experiment Agency-City of San Francisco)
Status: No further update, the interim report was submitted during the 01/31/02 meeting.
- 00-8 PEDESTRIAN COUNTDOWN SIGNAL HEAD (Tanda)
(Experiment Agency-City of San Jose)
Status: The City of San Jose has submitted the final study report during the May 2002 meeting. The Committee allowed continues use of the devices until to reach a final decision.
- 01-3 PEDESTRIAN COUNTDOWN SIGNAL HEADS (Fisher)
(Citywide Experiment request by the City of Fountain Valley)
Status: The City has submitted their final report to the Committee and has received approval to expand the experimentation as a citywide.
- 01-4 TACTILE PEDESTRIAN INDICATORE WITH AUDIBLE (Tanda)
INFORMATION (Experiment request by the City of Santa Cruz)
Status: No update.
- 01-7 PEDESTRIAN COUNTDOWN SIGNAL HEAD (Tanda)
(Experiment Agency-City of Oakland)
Status: The city has received approval from the HHWA and working to acquire funds in the FY 2002-03 budget.
- 01-9 IN-ROADWAY WARNING LIGHTS AT R/R CROSSINGS (Meis)
(Experiment requests by CPUC in cooperation Kern Co. & City of Fresno)
Status: CPUC is in process to hire consultant firm to conduct a study.
- 02-2 PEDESTRIAN COUNTDOWN SIGNAL HEAD (Tanda)
(Experiment Agency-City of Berkeley)
Status: The installation of the PCSHs will start later part of the year 2002.
- 02-4 PEDESTRIAN COUNTDOWN SIGNAL HEADS (Larsen)
(Experiment request by the County of San Luis Obispo)

- | | | |
|-------|--|--------------|
| 02-11 | Speed Feedback (Radar Speed) Sign
(Experimentation Agency – City of Garden Grove) | (Fisher) |
| 02-14 | Speed Feedback (Radar Speed) Sign
(Experimentation Agency – County of Mendocino) | (Mansourian) |
| 02-15 | Radar Guided Dynamic Curve Warning System
(Experimentation Agency – Caltrans D5) | (Meis) |

STATUS OF CALTRANS ACTION ON PAST ITEMS

- Item 90-7 **BICYCLE SIGNAL HEADS (BSH)**
The Traffic Manual has been changed to reflect the BSH warrants under the Section 9-01.5 of Chapter 9, Traffic signal and Lighting.
- Item 93-18 **CROSSWALKS, SEQUENTIAL LIGHTING (In-Roadway Warning Lights (IRWL) at Crosswalks)**
Caltrans developing Standard Special Provisions (SSP) for the IRWLs
- Item 99-3 **AUDIBLE PEDESTRIAN SIGNAL POLICY**
Caltrans will work with the CTCDC, the California Council of the Blind (CCB) and with individuals who are interested in this item to resolve along with the Agenda Item 01-5, "Accessible Pedestrian Signals."
- Item 01-1 **U-TURN SIGNAL HEADS INDICATOR**
Caltrans will develop appropriate standards to ensure visibility and make the U-turn signal head indicator an official traffic control device by inclusion in the Caltrans Traffic manual.
- Item 01-6 **SUPPLEMENT SIGNS ON CHANNELIZERS**
Caltrans will work with the Committee on this item.
- Item 00-4 **USE OF RAISED PAVEMENT MARKERS IN TRANSVERSE PATTERN**
Caltrans will take appropriate action on the recommendation made by the Committee.
- Item 01-5 **ACCESSIBLE PEDESTRIAN SIGNALS**
Caltrans will take appropriate action to adopt the MUTCD verbiage into the Traffic Manual.
- Item 02-3 **RIGHT EDGELINE**
Caltrans will take appropriate action on the recommendation made by the Committee.

03-2 Speed Feedback (Radar Speed) Sign

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City of Whittier

13230 Penn Street, Whittier, California 90602-1772
(562) 464-3510 Fax (562) 464-3572

December 9, 2002

Mr. John Fisher
City of Los Angeles Department of Transportation
221 North Figueroa Street, Room 500
Los Angeles, CA 90012

PROPOSAL FOR EXPERIMENTAL USE OF A NON-STANDARD TRAFFIC CONTROL DEVICE – RADAR SPEED SIGNS

The City of Whittier requests permission to conduct an experiment using active radar speed signs as a non-standard traffic control device to determine its effectiveness in reducing speeds around school zones.

1. PROBLEM STATEMENT

Traffic safety conditions in the City of Whittier are increasingly demanding for children, calling for greater awareness than ever before. Sight distance is obstructed, approach speed is relatively high, and traffic volume is heavy at critical crossing locations where many children are present. School-age children are especially vulnerable to pedestrian crashes. They are often small in stature and difficult for drivers to see. Children can also lack good judgment when crossing streets.

Existing Conditions

All of the proposed locations are for schools that have frontage on arterial streets with multi-lanes, secondary or collector streets. The attached maps show locations of the schools along with average daily trips (ADT) and posted speed limits. The City's current speed survey posted speed limits for 25-40 MPH on these roadways. It is very difficult for drivers to slow down to a school zone speed of 25 MPH when the posted speed limit for the street is 30 to 40 MPH. These conditions create a hazardous traffic environment for schoolchildren.

Statistical Data

A total of 153 traffic collisions have occurred during normal school arrival and departure times between the hours of 7:00 A.M. and 4:00 P.M. over the past eight years within the school zones that are situated contiguously along arterial highways.

03-2 Speed Feedback (Radar Speed) Sign

2 of 4

Proposal for Experimental Use of a Non-standard Traffic Control Device—Active Radar Speed Signs
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Page 2 of 4

2. PROPOSED SOLUTION

The City of Whittier wishes to participate in the experimentation of the Active Radar Speed Signs at least (9) high-volume, high speed school crossings. These permanent signs will offer state-of-the-art solutions to improve sign visibility, alert drivers, and protect children at school crossings. The Driver Feedback Speed Sign gives the motorist passing through a school zone real-time feedback as to their vehicle's speed. If the driver's speed exceeds the posted speed limit by more than 5 mph, LEDs will flash to further alert the driver.

The proposed locations are Laurel Elementary, East Whittier Intermediate, Whittier High, Lydia Jackson Elementary, Longfellow Elementary, West Whittier Elementary, Lincoln Elementary, La Serna High and Leffingwell Elementary. One (1) sign will be posted in each direction in front of each school. One of the main reasons of seeking CTCDC's permission is to receive funding approval from the Office of Traffic Safety and Hazard Elimination Safety in experimenting with the active radar speed signs.

3. OBJECTIVE

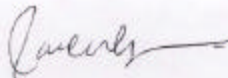
The objective of the test will be to determine the usage and effectiveness of the radar speed signs in reducing speeds and thereby improving pedestrian safety.

4. EXPERIMENT SCHEDULE

- Pre-installation Evaluation.....January to March 2003
- Installation..... April to June 2003
- Experimental Period.....July to December 2003
- Evaluation of Results.....January to March 2004

We appreciate your consideration of this request. The City of Whittier is looking forward to receiving a positive response from the Committee. Please feel free to call me at (562) 464-3510 if you have any questions or comments.

Sincerely,



Joe C. Dyer
City Traffic Engineer

JCD:jlh
(CTCradar-Whittier)

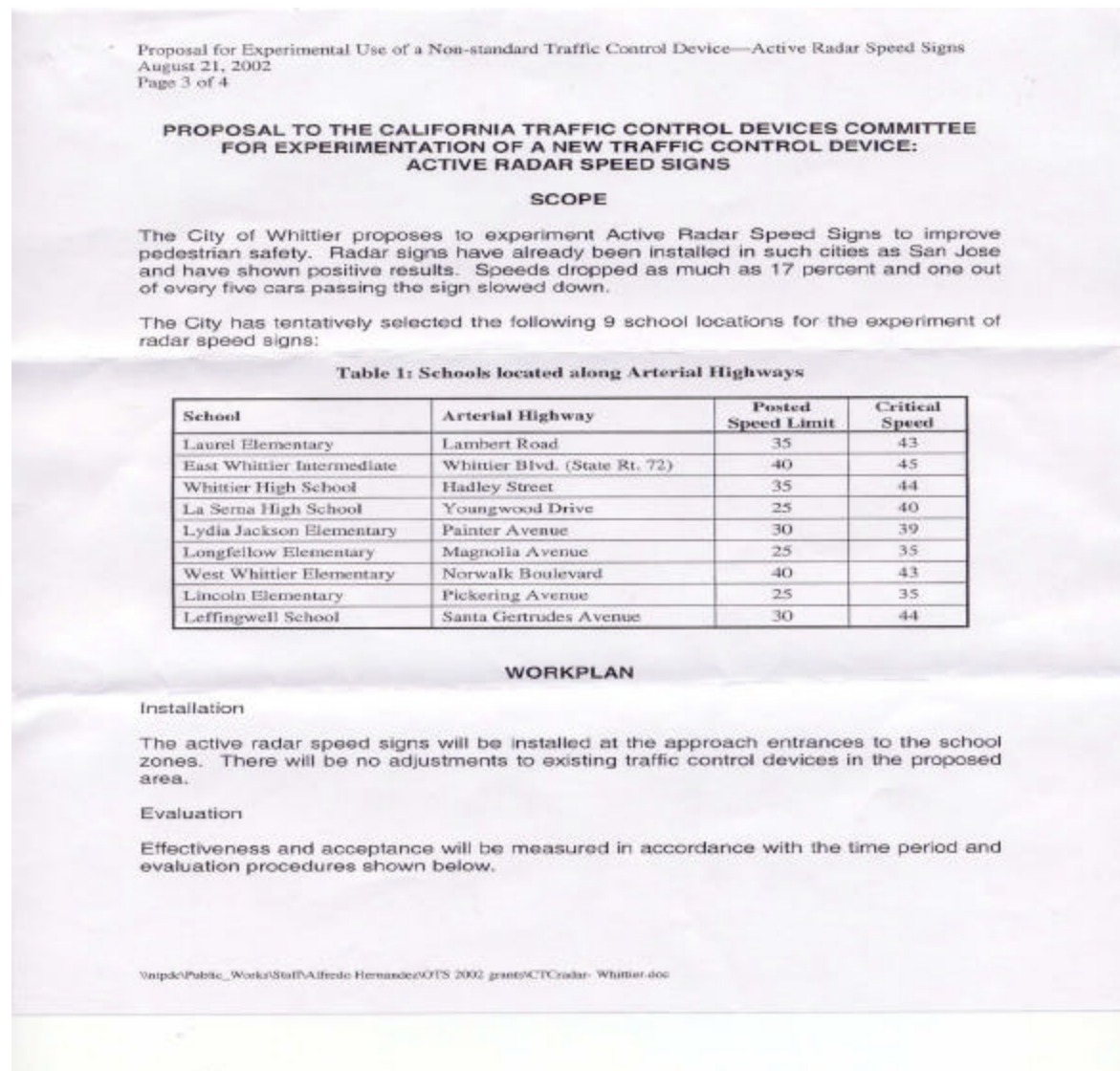
Enclosure

CC: Mr. Devinder Singh, Executive Secretary CTCDC

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03-2 Speed Feedback (Radar Speed) Sign

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**Addition to the original list:**

In our proposal letter for an Experimental Use of a Non-Standard Traffic Control Device Radar Speed Sign, dated December 9, 2002, we submitted a tentative list. Upon further review, the City would like to add the following locations to the list if funding is available:

1. Lambert Road near Milton Avenue (Evergreen Elementary School)
2. Laurel Avenue south of Lambert Road (Laurel Elementary School)
3. Santa Gertrudes Avenue near Citrustree Road (Leffingwell Elementary School)
4. Janine Drive east of Grovedale Avenue (Murphy Ranch Elementary School)
5. Ocean View Avenue north of Second Street (Ocean View Elementary School)

03-2 Speed Feedback (Radar Speed) Sign

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Proposal for Experimental Use of a Non-standard Traffic Control Device—Active Radar Speed Signs
August 21, 2002
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Time Period

The schedule for testing is as follows:

- Pre-installation Evaluation.....January to March 2003
- Installation..... April to June 2003
- Experimental Period.....July to December 2003
- Evaluation of Results.....January to March 2004

EVALUATION PROCEDURES

The City of Whittier requests that the Committee approve the preliminary evaluation plan outlined below. Other criteria and procedures may evolve during the evaluation period. These additional ways of evaluating the use of radar signs and any changes in procedures added to the assessment criteria will be discussed in the scheduled reports submitted to the project sponsor and the Committee.

- a. Installation Documentation – to be prepared by the City of Whittier personnel.
- b. Maintenance Recording – to be performed throughout the life of the experimentation period. A separate maintenance log sheet will be created for each site. Periodic inspections will be performed and logged by City of Whittier personnel.
- c. Accident data will be monitored and analyzed by the City of Whittier personnel.
- d. Observation will be conducted to determine the effectiveness of the operation. Public input from the school district as well as the PTAs will be used to help document the progress of the program as well as for reporting to the Committee, Caltrans, and other interested agencies.

Measures of effectiveness and acceptance during the before and after the testing period may include, but are not limited to, the following actions:

- i. Compare the total number of pedestrian accidents or the pedestrian accident rates
- ii. Conduct speed surveys

ADMINISTRATION

Sponsoring Agency: City of Whittier

Contact Information: Joe C. Dyer, P.E.
City Traffic Engineer, City of Whittier
Tel: (562) 464-3510
Fax: (562) 464-3572
E-mail jdyer@whittierch.org

Manufactures: Vendors to be determined by March 2003

Installations: To be installed by the City of Whittier Electrical Division personnel

99-18 Ground Mounted LED Lights On Stop Bars

P 1 of 1

During the last CTCDC meeting, Chairman Larsen stated that the City of Anaheim should be contacted and invited to the next CTCDC meeting to provide their opinion on the experimentation and whether they would like to pursue experimentation at the national level.

Note: The Committee Secretary was directed to contact the City of Anaheim to receive an update on LEDs and request them to attend the next CTCDC meeting. The City has confirmed that LEDs has been removed and they will attend the next CTCDC meeting to provide their experience on LEDs used at the controlled intersection.

00-9 Pedestrian Countdown Signal Head

During the December 2002 meeting, the City of Stockton has submitted the final report on the experiment with pedestrian countdown signal heads (PCSHs). The Committee will make decision on the report and the devices that were installed under this experimentation.

02-10 Pedestrian Countdown Signal Heads (PCSHs)

Chairman Larsen asked to place this item on the agenda for further discussion. During the last meeting, Chairman Larsen briefed the Committee and audience that the PCSHs item is not an experimentation request. The purpose of this item on the agenda was for the Committee to review the ongoing experiment and find ways to bring the item to a close. He pointed out the proposed MUTCD Revision 2 has included text on the PCSHs, which is similar to the recommendations provided to the experimental agencies by the Committee. At this point, seven public agencies have installed these devices under experimentation and there is interest shown by others to install these devices. At some point, the Committee will make recommendations that Caltrans adopt this device in California. Chairman Larsen asked for input from the Committee members.

Gerry Meis agreed with Jim's articulation and noted that he would like to know at some point if California wants to adopt the MUTCD text or if different standards should be developed.

John Fisher questioned if the language proposed in the MUTCD Revision 2 is adequate. Data submitted to the committee shows that the devices are helpful in improving pedestrian crossing. This morning, Garry Tsutsumi, City of Stockton, suggested that PCSHs are a useful device on wider roadways, because information given on the countdown is helpful for a pedestrian to make the decision whether to proceed or not. The data also indicated that more pedestrians are stepping off the curb during the "flashing hand" (don't walk), and at the same time, more pedestrians are completing their cross within countdown signals. He suggested seeing more data and input from the experimental agencies. That may trigger the use of different guidelines in California compared to the MUTCD Revision 2. The proposed text in the MUTCD was included in a rush, and California might come up with better guidelines.

Farhad Mansourian shared that there are public agencies under the impression that this is an approved traffic control device and they are installing these countdown devices. He further added that there are vendors too, who are telling cities that this is an approved traffic control device. He asked the Committee to communicate with local agencies to inform them that this is not an approved traffic control device and at the same time, the Committee should look into ways to come up with final guidance.

Gary Tsutsumi stated that the PCSHs were programmed so that the countdown display begins at the start of the flashing "upraised hand" (Don't Walk) interval. The Traffic signal controller was programmed in such a way that the countdown timer reaches "zero" at or prior to the beginning of the yellow vehicle clearance interval. The City of Stockton uses a one-second "all red" interval at the end of the yellow interval. Therefore, the pedestrians are provided the "yellow clearance" interval and "all red" interval in addition to the "walk" and "walk clearance" interval prior to a conflicting phase receiving the green indication.

Dennis Dunn, County of Sacramento, stated that the County of Sacramento was the first local agency to install PCSHs and submitted their final report a few years back.

Gerry Meis noted that the Committee has not received any final report from the County of Sacramento. The only information the County has submitted to this Committee was that the County decided to terminate collection of the data due to the shortage of personnel and that the County would submit a final report after getting data from other jurisdictions who are experimenting with PCSHs.

There was lengthy discussion by the Committee on how to inform public agencies that the countdown is not an approved traffic control device yet. There was an opinion to issue "interim guidelines" with the help of agencies conducting experimentation with countdown signals. Others asked about the legality of the "interim guidelines."

The Committee suggested including the following statement in the minutes:

- The pedestrian countdown signal head is not an "officially approved traffic control device" in California.
- The Federal Highway Administration also has a draft text in the MUTCD Revision 2, on PCSHs, under Section 4E.07. The final text is anticipated to be published in the latter part of 2003.
- Local agencies are encouraged to receive approval from the CTCDC, if they plan to install PCSHs or wait for the Committee to issue a final decision on completion of the on-going experimentation.

03-2 Establishment of Speed Limit on Unpaved Roads

The San Bernardino County Department of Public Works would like to request to add an agenda item for December 5, 2002, to discuss the methodology and guidelines to establish speed zone on unpaved roads. The subject was requested in the last CTCDC meeting of August 22, 2002.

For your information, portion of State Route 173 is unpaved from milepost L7.754 to 12.722. State Route 173 is in District 8, within the San Bernardino County.

03-3 National Weather Services Signing (Tsunami)

1 of 2

The National Oceanic and Atmospheric Administration (NOAA) is collaborating with the Pacific Coast states to mitigate tsunami hazards. Part of the process is to identify and map tsunami hazard zones and evacuation routes. This is very similar to the hurricane hazard zones and evacuation routes of the eastern United States. NOAA's National Weather Service and the City of Crescent City desire to post signs developed by the Oregon Department of Transportation delineating the zones and routes. Other communities could use the signs as needed.

03-3 National Weather Signing

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99-11 MUTCD Adoption By Caltrans

Caltrans will update the Committee on the status of the MUTCD adoption.

00-1 Bicycle Pavement Markings

1 of 7

San Francisco Pavement Arrow Study: Technical Memorandum #1

November 8, 2002 1

To: Mike Sallaberry

CC: Peter Tannen

From: Mia Birk & Michelle DeRobertis

Date: November 8, 2002

Re: Pavement Arrow Study, Technical Memorandum #1 **Street Selection****Introduction**

The purpose of this memorandum is to outline the methodology used to select the study streets for the placement of the bicycle pavement marking. The purpose of the pavement marking is to:

- Inform motorists to expect bicyclists on the roadway
- Inform motorists that bicyclists may indeed ride further to the left in the travel lane
- Inform bicyclists how to position themselves in the lane with respect to the curb or parked cars to avoid hazards
- Reinforce to bicyclists the correct direction of travel
- Reinforce to bicyclists that riding on the roadway as opposed to the sidewalk is correct behavior

There are several conditions that affect a bicyclist's position within a travel lane: the width of the curb lane, the presence of on-street parking, the Average Daily Traffic (ADT), and the speed of the traffic. The ADT (a measure of the ability to pass a cyclist freely versus the motorist having to wait for a break in traffic) and speed affect the position of the bicyclist due to the pressure (intimidation factor) a bicyclist feels to ride to the far right of the roadway even if it means riding in the "door zone".

There are also several conditions that affect a motorist's behavior when passing a bicyclist: again the curb lane width but also the number of lanes per direction. For example if there are two more lanes eastbound, then a motorist following a bicyclist has the option of changing lanes, whereas as if there is only one lane per direction, the motorist following a bicyclist must cross the centerline in order to pass. Therefore, on a two-lane road, the type of centerline is also a factor along with the ADT (i.e. probability of encountering opposing traffic) and sight distance to opposing traffic.

San Francisco has many conditions for which the use of the pavement marking has been suggested. The most significant issue is the presence of on-street parking and whether a pavement marking could help decrease the incidence of dooring. This is particularly an issue on narrow curb lane streets (19 feet or less per lane with parking) but also on wider curb lane streets (20-22 feet).

There have been other studies of the effect of a pavement marking on the above issues. A Florida study addressed the effect of a marking on a road with wide curb lanes and found a positive impact on motorist and bicyclists positioning. However, the difference, though statistically significant, was only a few inches.

Many other communities-Chicago, Portland, Paris, Brisbane (Australia), Cambridge, and Oakland-are using variations of the proposed shared use pavement marking. A summary of this information is contained in Appendix A. All these cities have different goals and conditions. The methodology for this study must address how to assess the effectiveness of a pavement marking given typical San Francisco conditions.

00-1 Bicycle Pavement Markings

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San Francisco Pavement Arrow Study: Technical Memorandum #1

Methodology/Analysis

The scope of work defined by DPT was to analyze four locations. Since San Francisco's primary motivation is the high accident history of dooring, it was important to select at least two streets with onstreet parking. The accident rate of a street was also a factor, since the ultimate goal is to reduce accidents through the use of the pavement marking. Given the number of variables, the intent was to select study streets with as few variations as possible, so that common conclusions could be drawn between the four study streets.

DPT provided the consultant with several streets with a known high volume of bicycle traffic. This was important since the more bicyclists on the road, the easier it will be to measure the effect of the pavement marking on motorist-bicyclist interactions. The streets were then compared based on the presence of onstreet parking, the number of travel lanes, curb lane width, and accident history. This comparison is presented in the attached Table 1.

Given the candidate streets, it was decided to select streets that all had the following in common:

- On-street parking
- Moderate speeds
- If a one-lane road, it has a dashed centerline and good sight distance

Recommendation:

Of the streets shown in Table 1., the streets with the highest accident rate were Polk Street, Second Street, 17th Street and Market Street. They also met the criteria listed above that would keep the number of variables to a minimum. Therefore we recommend the following four streets:

Table 2: Recommended Study Streets

Street	Location	Number of lanes	Curb lane width	ADT
Polk Street	between Post and Union	two-lane road	moderate-wide curb lane width	high ADT/lane
17th Street	between Noe and Dolores/1/	two-lane road	moderate-wide curb lane width	Moderate ADT/lane
Second Street	between Market and Harrison	four-lane road	narrow curb lane width	Moderate ADT/lane
Market Street	between Van Ness and Octavia	four-lane road	narrow curb lane width	high ADT/lane

/1/ 17th Street between Dolores and Valencia had been previously marked with green pavement arrows. It is recommended to also mark this section with the new markings, but the location should not be part of the videotaped Before and After studies.

00-1 Bicycle Pavement Markings

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San Francisco Pavement Arrow Study: Technical Memorandum #1

Street	Location	Quad	Time Period	ADT	ADT Lane	Lanes per Direction	Curb lane Width	Parking
Polk Street	between Post & Union	NE	AM and PM Peak	11,000-16,000	5500-8000	1 dashed centerline	22	yes
2 nd Street	Between Market & Harrison	NE	AM and PM Peak	10,000-16,000	2,500-4,000	2	17	yes
Fell	Between Scott & Baker	NW	PM Peak	37,000	9,000	3+	12	no
17	Between Noe & S. Van Ness EB & WB video tape between Noe & Dolores (green marking were placed between Dolores and Valencia)	NE	AM and PM Peak	5,500-8,000	2,750-4,000	1 dashed centerline	22	yes
8 th Ave	Between Lake & Fulton	NW	Weekend	1,500-3,000	750-1500	1 (no cent-line)	40 (curb-curb)	Yes
Transverse St	Between Fulton & MLK jr.	NW	Weekends	4,000-8,000	200-4,000	1 (no cent-line)	31-43 (curb-curb)	yes
Page St	Between Stanyan & Baker EB & WB	NW	AM and PM Peak	3,000-6,000	1,500-3,000	1 (no cent-line)	38' 9" (curb-curb)	yes
Market St	Between Van Ness & Octavia	NE	AM and PM Peak	30,000-40,000	8,000-10,000	2-4	11'-19'	Yes & no

00-1 Bicycle Pavement Markings

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November 8, 2002 1

To: Mike Sallaberry

CC: Peter Tannen

From: Mia Birk & Michelle DeRobertis

Date: November 8, 2002

Re: Pavement Arrow Study, Technical Memorandum #2
Study Procedure**Introduction**

The purpose of this memorandum is to articulate the goals of the study and to outline parameters of the study so that the goals can be effectively addressed. The consultant met with DPT staff and discussed various applications and ways of approaching this study. The Consultant then developed the following research objective and study parameters to accomplish the objective.

Research Objective

The purpose of the pavement marking is to inform motorists and bicyclists of the appropriate position for bicyclists to ride on a roadway without bike lanes. Secondary goals are to reduce aggressive behavior on the part of motorists and to encourage correct road riding on the part of bicyclists. The overriding goal is to improve safety as measured by reported accidents over a three-year period.

Measures of Effectiveness (MOE)

The effectiveness at meeting these goals will be measured by the following criteria. These MOEs will be measured at each study location before the marking is placed and again after the marking is placed. The specifics of the marking placement and videotaping methodology are presented in Technical Memorandum #3.

MOEs for Goal 1: Position of the Bicyclists and Motorists

- Distance of bicyclist from adjacent parked cars
- Distance of motorist when passing a bicyclist

Note: all study streets have on-street parking, however, if there is no parked car at the study site the measurement shall be to the curb face.

MOEs for Goal 2: A Reduction in Aggressive Motorist Behavior.

- observable hostile behaviors such as honking, gestures or other behaviors when passing or waiting to pass a bicyclist
- the time the motorist waited behind a bicyclist for a safe opportunity to pass

MOEs for Goal 3: Reduction in Improper Bicycle Behavior

- number of bicyclists riding on the sidewalk
- number of bicyclists riding wrong-way on the street

MOEs for Goal 4: Reduction in Accidents (three year period before and after)

- total bicycle/motor vehicle accidents
- number of dooring accidents
- number of left-turn accidents

Note: The study will be complete before the three year monitoring period is over, thus the City should continue to monitor accidents after the study is complete.

00-1 Bicycle Pavement Markings

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Pavement Arrow Study, Technical Memorandum #2**Study Procedure**

To narrow the scope of the study, a single size and shape of the marking will be used. The design and size of the marking was determined using human factors research and is documented in Technical Memorandum #4. The four study streets all have on-street parking and are streets with moderate speeds.

Pavement Arrow Study, Technical Memorandum #2

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These commonalities help to reduce the variables involved so that the study findings can be more easily compared. These four study locations are:

Table 1: Recommended Study Streets

Street	Location	Number of lanes	Curb lane width	ADT
Polk Street	between Post and Union	two-lane road	moderate-wide curb lane width	high ADT/lane
17th Street	between Noe and Dolores/1/	two-lane road	moderate-wide curb lane width	Moderate ADT/lane
Second Street	between Market and Harrison	four-lane road	narrow curb lane width	Moderate ADT/lane
Market Street	between Van Ness and Octavia	four-lane road	narrow curb lane width	high ADT/lane

/1/(17th Street between Dolores and Valencia had been previously marked with green pavement arrows. It is recommended to also mark this section with the new markings but should not be the location of the videotaped Before and After studies.

/2/Heavy ADT is defined as more than 4000 vehicles per day per lane of traffic. Moderate ADT is defined as between 2000 and 4000 vehicles per day per lane of traffic.

These locations can be summarized as:

- Two-lane road with on-street parking, moderately wide curb lane: moderate to heavy ADT
- Four lane road with on-street parking, narrow curb lane: moderate to heavy ADT

Once the “before and after” data is collected, it will first be analyzed according to the MOEs at each individual location. In this way, the research will determine the effectiveness of the marking under the conditions of that particular street. Then the data will be analyzed to determine if there was a significant difference between the effectiveness of the marking on a street with heavy ADT versus moderate ADT. The ADT is a measure of the motorist’s ability to pass the cyclist freely versus its need to wait for a break in traffic.

The data will also be analyzed to determine the differences between the marking on a two-lane road versus a four-lane road. Four-lane roads have an adjacent lane for motorist passing, while two-lane roads do not. There may be differences in the way motorists react to the marking given those differences. This will be measured by the motorist aggressiveness MOEs of observed hostile behavior exhibited by motorists while waiting to pass.

It is acknowledged that the two-lane roads in the study have 22 foot curb lanes while the four-lane roads have 17 foot curb lanes. However, these two conditions are the most typical for San Francisco so it was determined that it was important to study these two conditions.

00-1 Bicycle Pavement Markings

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November 8, 2002 1

To: Mike Sallaberry

CC: Peter Tannen

From: Mia Birk & Michelle DeRobertis

Date: November 8, 2002

**Re: Pavement Arrow Study, Technical Memorandum #3
Methodology****Introduction**

The purpose of this memorandum is to identify the marking placement standards and the video taping methodology for the pavement marking study.

Marking Placement

Longitudinal: The marking should be installed at the beginning and ending of each block within 20 feet of the crosswalk or extension of the sidewalk. It should also be installed every 200 feet or in the middle of the block.

Lateral: The centerline of the marking should be placed 9.5 feet from the curb face.

Additional markings (12" by 12" marks) should be added at the following points to allow measuring bicycle rider and motor vehicle position in the videotapes:

- 7.5 ft
- 8.5 ft
- 10.5 ft
- 11.5 ft

Videotaping Methodology

- Videotaping will occur on four streets (see below) at two locations per street to capture both directions of travel for a total of 8 video locations.
- The filming is to be conducted within a 14 day period on weekdays. National holidays will be avoided.
- At each location Monday through Friday, either the peak commute hours of 7-9 am or 4-6 pm will be filmed for four days. This provides 2 hrs of film for 4 commute days (8 hrs.) at each location, or 16 hours per street.
- This will provide 64 total hours of filming BEFORE installation of the arrows.
- The exact same sequence of filming will occur in the late fall and early spring AFTER installation of the arrows, for a total of 192 hours of taping.

00-1 Bicycle Pavement Markings

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Pavement Arrow Study, Technical Memorandum #3

Videotaping Locations

Street	Location	Number of lanes	Suggested video camera Location/1/	
			NB	SB
Polk Street	between Post and Union	two-lane road	Clay & Jackson	California & Bus
17th Street	between Noe and Dolores/1/	two-lane road	EB Church & Dolores	WB-Sanchez & Chum
Second Street	between Market and Harrison	four-lane road	Howard & Mission	Folsom & Harrison
Market Street	between Van Ness and Octavia	four-lane road	Gough & Franklin	Gough & Franklin

/1/ to be field checked again before videotaping and marking placement

/2/ 17th Street between Dolores and Valencia had been previously marked with green pavement arrows. It is recommended to also mark this section with the new markings but should not be the location of the videotaped Before and After studies.

Data to be Collected (also outlined in TM #2)

The videotape should be set up so that the following information can be derived:

- Distance between cyclists and parked vehicles
- Distance between cyclist and curb (where there is no on-street parking)
- Motor vehicle distance from parked vehicles
- Motor vehicle distance from curb (where there is no on-street parking)
- Distance between motor vehicles and cyclists when motorist passes cyclist
- Number and frequency of conflicts (hostile behavior such as honking, gestures, etc)
- Time motorist spends behind cyclists before passing
- Number of cyclists riding on the sidewalk adjacent to the study site

STATUS OF CALTRANS ACTION ON PAST ITEM**90-7 Bicycle Signal Head (BSH)**

The following text has been included in Chapter 9, (Traffic Signals and Lighting) of the Traffic Manual, under Section 9-01.5:

9-01.5 Bicycle Signals

A bicycle signal is an electrically powered traffic control device that may only be used in combination with an existing traffic signal. Bicycle signals shall direct bicyclists to take specific actions and may be used to address an identified safety or operational problem involving bicycles.

When bicycle traffic is controlled, only green, yellow and red lighted bicycle symbols, shall be used to implement bicycle movement at a signalized intersection. The application of bicycle signals shall be implemented only at locations that meet Department of Transportation Bicycle Signal Warrants. This will remain in effect until January 1, 2005.

A separate signal phase for bicycle movement will be used. Alternative means of handling conflicts between bicycles and motor vehicles shall be considered first. Two alternatives that should be considered are:

1. Striping to direct a bicyclist to a lane adjacent to a traffic lane such as a bike lane to the left of a right-turn-only lane.
2. Redesigning the intersection to direct a bicyclist from an off-street path to a bicycle lane at a point removed from the signalized intersection.

A bicycle signal phase will be considered only after these and other less restrictive remedies have had an adequate trial with enforcement and with the result that the collision frequency has not been reduced.

Bicycle Signal Warrant

A bicycle signal may be considered for use only when the volume and collision or volume and geometric warrants have been met:

1. *Volume*. When $W = B \times V$ and $W \geq 50,000$ and $B \geq 50$.

Where: W is the volume warrant.

B is the number of bicycles at the peak hour entering the intersection.

V is the number of vehicles at the peak hour entering the intersection.

B and V shall use the same peak hour.

2. *Collision*. When 2 or more bicycle/vehicle collisions of types susceptible to correction by a bicycle signal have occurred over a 12-month period and the responsible public works official determines that a bicycle signal will reduce the number of collisions.
3. *Geometric*. (a) Where a separate bicycle/multi use path intersects a roadway. (b) At other locations to facilitate a bicycle movement that is not permitted for a motor vehicle.